

Attorney Docket No. 13DV-14080 (07783-0096)

**C. AMENDMENTS TO THE CLAIMS**

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claim 1 (currently amended) A process for forming diffusion aluminide coatings on an uncoated surface of a substrate, without interdiffusing a sufficient amount of aluminum into a coating layer to adversely affect the coating growth potential or mechanical properties of said coating layer, comprising the steps of:

providing a metal substrate comprising an external surface and an internal passage therein defined by an internal surface, at least a portion of the external surface of the substrate being coated with a coating layer selected from the group consisting of  $\beta$ -NiAl-base, MCrAlX, a line-of sight diffusion aluminide, a non-line-of-sight diffusion aluminide, a pack diffusion aluminide, and a slurry diffusion aluminide on said substrate, wherein the substrate is a gas turbine airfoil, and wherein the internal passage is a plurality of internal cooling passages which extend through an interior of the airfoil;

cleaning the external surface of the substrate;

subjecting the metal substrate to a aluminum vapor phase deposition process performed using a fluorine-containing activator selected from the group consisting of  $\text{AlF}_3$ ,  $\text{CrF}_3$ ,  $\text{NH}_4\text{F}$ , and combinations thereof, at a rate in the range of about 0.036 mols of fluorine per  $\text{ft}^3/\text{hr}$  of transport gas to about 0.18 mols of fluorine per  $\text{ft}^3/\text{hr}$  of transport gas, at a temperature in the range of about 1350°F to about 1925°F, using a transport gas selected from the group consisting of argon, nitrogen, hydrogen, and combinations thereof, the transport gas being provided at a flow rate in the range of about 20  $\text{ft}^3/\text{hr}$  to about 120  $\text{ft}^3/\text{hr}$  for a period of time in the range of about 2 hours to about 10 hours; and

cooling the substrate.

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Claim 2 (original) The process of claim 1, wherein the coating layer is a  $\beta$ -NiAl-base layer.

Claim 3 (original) The process of claim 2, wherein the coating layer is a  $\beta$ -NiAlCrZr layer.

Claim 4 (original) The process of claim 3, wherein the  $\beta$ -NiAlCrZr coating layer comprises about 53.5 weight percent nickel to about 64.5 weight percent nickel, about 20 weight to about 30 weight percent aluminum, about 2 weight percent to about 15 weight percent chromium, and about 0.5 weight percent to about 1.5 weight percent zirconium.

Claim 5 (original) The process of claim 4, wherein the  $\beta$ -NiAlCrZr coating layer comprises about 60 weight percent nickel, about 27 weight percent aluminum, about 12 weight percent chromium, and about 1 weight percent zirconium.

Claim 6 (original) The process of claim 1, wherein the coating layer is a non-line-of-sight diffusion aluminide layer comprising aluminum, chromium, and a material selected from the group consisting of a reactive element, a noble metal, and combinations thereof.

Claim 7 (original) The process of claim 1, wherein the coating is a pack diffusion aluminide layer comprising aluminum, chromium, and a material selected from the group consisting of a reactive element, a noble metal, and combinations thereof.

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Claim 8 (original) The process of claim 1, wherein the coating is a slurry diffusion aluminide layer comprising aluminum, chromium, and a material selected from the group consisting of a reactive element, a noble metal, and combinations thereof.

Claim 9 (original) The process of claim 1, wherein the coating layer is MCrAlX, where M is a metal selected from the group consisting of iron, cobalt, nickel, and combinations thereof.

Claim 10 (original) The process of claim 1 further comprising the additional step of densifying and smoothing the coating layer using a shot peen treatment prior to the step of cleaning the external surface of the substrate.

Claim 11 (original) The process of claim 1 further comprising the additional step of masking a preselected external portion of the substrate prior to the step of subjecting the metal substrate to an aluminum vapor phase deposition process.

Claim 12 (original) The process of claim 1 further comprising the additional step of subjecting the coating layer to a surface finish treatment to reduce the roughness of the coating layer.

Claim 13 (original) The process of claim 1 further comprising the additional step of applying a thermal bond coat to the coating layer.

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Claim 14 (original) The process of claim 12 further comprising the additional step of applying a thermal bond coat to the coating layer.

Claim 15 (original) The process of claim 1, wherein the aluminum vapor phase deposition process is performed using an  $\text{AlF}_3$  activator at a rate of 0.036 mols of fluorine per  $\text{ft}^3/\text{hr}$  of transport gas, at a temperature of about  $1900^\circ\text{F}$ , the transport gas being provided at a flow rate of about  $20 \text{ ft}^3/\text{hr}$  for a period of time of about 6 hours.

Claim 16 (original) The process of claim 4, wherein the aluminum vapor phase deposition process is performed using an  $\text{AlF}_3$  activator at a rate of 0.036 mols of fluorine per  $\text{ft}^3/\text{hr}$  of transport gas, at a temperature of about  $1900^\circ\text{F}$ , the transport gas being provided at a flow rate of about  $20 \text{ ft}^3/\text{hr}$  for a period of time of about 6 hours.

Claim 17 (original) The process of claim 5, wherein the aluminum vapor phase deposition process is performed using an  $\text{AlF}_3$  activator at a rate of 0.036 mols of fluorine per  $\text{ft}^3/\text{hr}$  of transport gas, at a temperature of about  $1900^\circ\text{F}$ , the transport gas being provided at a flow rate of about  $20 \text{ ft}^3/\text{hr}$  for a period of time of about 6 hours.

Claims 18 - 27 (Cancelled)

Claim 28 (new) A process for forming diffusion aluminide coatings on an uncoated surface of a substrate, without interdiffusing a sufficient amount of aluminum into a coating layer to adversely affect the coating growth potential or mechanical properties of said coating layer, comprising the steps of:

providing a metal substrate comprising an external surface and an internal passage therein defined by an internal surface, at least a portion of the external

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surface of the substrate being coated with a coating layer selected from the group consisting of  $\beta$ -NiAl-base, wherein the  $\beta$ -NiAl-base is  $\beta$ -NiAlCrZr, MCrAlX, a line-of sight diffusion aluminide, a non-line-of-sight diffusion aluminide, wherein the non-line-of-sight diffusion aluminide layer comprising aluminum, chromium, and a material selected from the group consisting of a reactive element, a noble metal, and combinations thereof, a pack diffusion aluminide, and a slurry diffusion aluminide on said substrate, wherein the substrate is a gas turbine airfoil, and wherein the internal passage is a plurality of internal cooling passages which extend through an interior of the airfoil;

cleaning the external surface of the substrate;

subjecting the metal substrate to a aluminum vapor phase deposition process performed using a fluorine-containing activator selected from the group consisting of  $\text{AlF}_3$ ,  $\text{CrF}_3$ ,  $\text{NH}_4\text{F}$ , and combinations thereof, at a rate in the range of about 0.036 mols of fluorine per  $\text{ft}^3/\text{hr}$  of transport gas to about 0.18 mols of fluorine per  $\text{ft}^3/\text{hr}$  of transport gas, at a temperature in the range of about  $1350^\circ\text{F}$  to about  $1925^\circ\text{F}$ , using a transport gas selected from the group consisting of argon, nitrogen, hydrogen, and combinations thereof, the transport gas being provided at a flow rate in the range of about  $20 \text{ ft}^3/\text{hr}$  to about  $120 \text{ ft}^3/\text{hr}$  for a period of time in the range of about 2 hours to about 10 hours; and

cooling the substrate.

Claim 29 (new) A process for forming diffusion aluminide coatings on an uncoated surface of a substrate, without interdiffusing a sufficient amount of aluminum into a coating layer to adversely affect the coating growth potential or mechanical properties of said coating layer, comprising the steps of:

providing a metal substrate comprising an external surface and an internal passage therein defined by an internal surface, at least a portion of the external surface of the substrate being coated with a coating layer selected from the group consisting of  $\beta$ -NiAl-base, wherein the  $\beta$ -NiAl-base is  $\beta$ -NiAlCrZr, MCrAlX,

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a line-of sight diffusion aluminide, a non-line-of-sight diffusion aluminide, a pack diffusion aluminide, wherein the pack diffusion aluminide layer comprising aluminum, chromium, and a material selected from the group consisting of a reactive element, a noble metal, and combinations thereof, and a slurry diffusion aluminide on said substrate, wherein the substrate is a gas turbine airfoil, and wherein the internal passage is a plurality of internal cooling passages which extend through an interior of the airfoil;

cleaning the external surface of the substrate;

subjecting the metal substrate to a aluminum vapor phase deposition process performed using a fluorine-containing activator selected from the group consisting of  $\text{AlF}_3$ ,  $\text{CrF}_3$ ,  $\text{NH}_4\text{F}$ , and combinations thereof, at a rate in the range of about 0.036 mols of fluorine per  $\text{ft}^3/\text{hr}$  of transport gas to about 0.18 mols of fluorine per  $\text{ft}^3/\text{hr}$  of transport gas, at a temperature in the range of about  $1350^\circ\text{F}$  to about  $1925^\circ\text{F}$ , using a transport gas selected from the group consisting of argon, nitrogen, hydrogen, and combinations thereof, the transport gas being provided at a flow rate in the range of about  $20 \text{ ft}^3/\text{hr}$  to about  $120 \text{ ft}^3/\text{hr}$  for a period of time in the range of about 2 hours to about 10 hours; and

cooling the substrate.

Claim 30 (new) The process of claim 29, wherein the coating is a slurry diffusion aluminide layer comprising aluminum, chromium, and a material selected from the group consisting of a reactive element, a noble metal, and combinations thereof.